DEVELOPMENT OF PORTABLE STEM LABS TO SPARK INTEREST IN SCIENCE AMONG RURAL KANNADA MEDIUM STUDENTS

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Introduction:

India's rural education sector continues to face challenges in delivering quality science education due to lack of infrastructure, equipment, and language barriers. Many rural Kannada medium schools lack laboratories and exposure to hands-on experiments, making science abstract and difficult for students. This project aims to bridge that gap by developing a **portable STEM lab kit** specifically designed for **Kannada medium students**. The kits are compact, cost-effective, and designed with simple instructions in the Kannada language. These labs enable interactive, curriculum-linked experiments in physics, chemistry, and biology to be conducted directly in the classroom or even outdoor spaces. The initiative is aligned with NEP 2020's vision of promoting critical thinking and inquiry-based learning. This project empowers rural students by making science education engaging, contextual, and accessible, thus nurturing future innovators from the grassroots.

8. Objectives:

- To develop low-cost, portable STEM lab kits tailored for rural Kannada medium students.
- To translate scientific concepts into Kannada for better comprehension.
- To enhance hands-on learning experiences through simple, curriculum-aligned experiments.

- To assess student engagement and science learning outcomes before and after lab implementation.

Methodology:

The project began with a curriculum review of science subjects (Grades 6–10) in Karnataka state syllabus. A selection of key experiments in physics, chemistry, and biology was made to ensure they align with learning outcomes.

Prototypes of modular kits were created using locally available and safe materials (syringes, test tubes, lenses, magnets, wires, etc.).

Instruction manuals and experiment guides were created in Kannada with diagrams and pictorial steps to support visual learning.

Kits were tested in two selected government Kannada medium schools in rural areas. Pre- and post-intervention questionnaires assessed knowledge gain and interest.

Teachers were trained on kit usage and inquiry-based pedagogy. Student science clubs were involved for peer demonstrations.

Student/teacher feedback was collected to refine the prototypes for usability and effectiveness.

Results & Conclusions:

In conclusion, the project resulted in the successful development of three portable lab modules covering physics (optics and force), chemistry (acids-bases and reactions), and biology (cell observation, plant transport). Over 120 students participated in hands-on sessions across two schools.

Feedback showed increased curiosity, improved understanding of scientific concepts, and a greater willingness to pursue science beyond the classroom. Teachers reported ease of integration with syllabus and better classroom engagement. Graphs comparing pre- and post-test scores indicated up to 35% improvement in learning outcomes. The portable nature of the kits makes them ideal for rotating across schools, thereby benefiting a larger student base with minimal cost.

Project Outcome & Industry Relevance:

The project has strong implications for **educational NGOs, EdTech startups, and government agencies** working in rural education. It supports NEP 2020's goals and is suitable for CSR funding in education. The STEM kits can be mass-produced and deployed in thousands of government schools lacking laboratories. This model promotes equitable access to science education and nurtures early scientific temper in underserved communities.

Working Model vs. Simulation/Study:

This project involved the development of a physical working model in the form of a portable, hands-on STEM lab kit.

Project Outcomes and Learnings:

Developed scalable, language-friendly STEM kits for rural Kannada medium students.

Observed increased engagement and performance in science concepts.

Learned to integrate design thinking with educational pedagogy.

Understood the importance of cultural and language relevance in educational tools.

Acquired skills in prototyping, user-testing, and curriculum alignment.

Future Scope:

The future scope of this project includes:

1. Expanding the experiment library across all high school grades.
2. Digitizing instructions through QR-based Kannada video guides.
3. Partnering with CSR initiatives for large-scale kit distribution.
4. Integrating solar-powered display screens for outdoor demonstration.
5. Creating versions of the kits for English and other regional language schools across India.
6. Training rural youth as facilitators to manage STEM lab outreach.
7. Exploring tie-ups with Karnataka Textbook Society and the Department of Education.

8. Adding sensors and IoT modules for advanced science projects.
9. Contributing to Atal Tinkering Labs and Start-up India missions.
10. Establishing community science clubs using the kits as a catalyst for grassroots innovation.